Who Holds the Right to Exclude for Machine Work Products?

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ABSTRACT

This article investigates whether the inventions and works created by Artificial Intelligence should be patentable and copyrightable and if so, who should be assigned these rights. This article uses US case law and incentive economics to answer these questions. This article discusses who of the machine, its creators, owners, or operators should be assigned the rights to exclude others if policymakers want to promote the progress of science and useful arts. All four candidates raise legal problems. Based on current law, the users may be able to patent their invention but other works would fall into the public domain. Assigning exclusion rights to any party distorts the incentives of the other parties. The Intellectual Property system is mal-adapted to deal with these intelligent machines. Instead, these inventions and works should fall into the public domain. The four candidates can use alternative business models to profit from the machine's creations.

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1 INTRODUCTION

Artificial Intelligence (AI) can be protected by patent rights as a method and by copyright protection as a software. AI interest has increased dramatically in the last 15 years. Figure 1 shows the evolution of the inclusion of the term "artificial intelligence" in US patent applications and granted patents that were applied between 2000 and 2016. This shows that inventors have increasingly included the term "artificial intelligence" in their applications. Granted patents containing "artificial intelligence" remain relatively stable.[2] This graph also shows that inventors have attempted to use patent to protect AIs.[3]

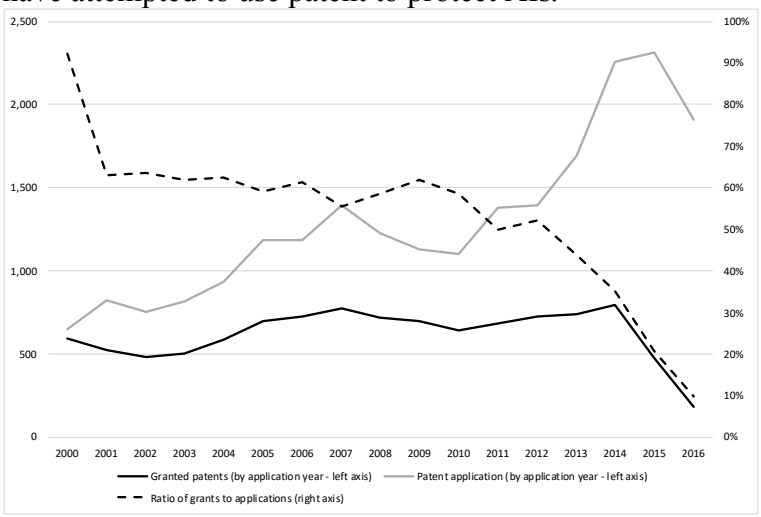

Figure 1: Patents (by application year) containing the term "artificial intelligence" (Source: Google Patents)

Artificial Intelligence has been defined in many different ways. The researchers who coined the term[4] focused on automated tasks, language use, neuron nets, calculations, self-improvements, abstractions, randomness and creativity.[5] Such software are more advanced than traditional executable programs but yet less advanced than human brain capabilities.

This article defines AIs as machines capable of creating new patterns. AI can create these new patterns through smart processes mimicking human inventiveness[6] or through machine learning where machines access past patterns to learn from them, recognize, and create new patterns.[7] While the two concepts differ, the difference is not germane to the present discussion.[8]

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[2] The drop in granted patents post 2015 is due to the data truncation. Data was collected from Google Patents on April 19, 2018.

[3] Artificial intelligence as a term could be under inclusive because it ignores patents that do not explicitly contain the term but protects a similar situated invention. The term is also over inclusive because patent holders may include the term without covering an invention that fit the definition. The USPTO has also a class (706 – Data processing: artificial intelligence), which deals with AI but it is also can be over and under inclusive.

[4] The etymology has been traced back to a research project started in 1955. John McCarthy, et al. *A proposal for the Dartmouth summer research project on artificial intelligence, August 31, 1955*, 27 AI MAGAZINE 12 (2006).

[5] *Id*. at 12-14.

[6] For example, the United States Judicial Panel on Multidistrict Litigation refers to software that are able to mimic fake users as "artificial intelligence 'bots'" In *re Ashley Madison Customer Data Security Breach Litig*., 148 F. Supp. 3d 1378, 1380 (J.P.M.L. 2015)(assigning jurisdiction).

[7] For example, a patent holder describing as "us[ing] artificial intelligence to provide insight into business's data through the use of predictive modeling" sues for infringement an "an open-source software company that provides a machine learning platform" because the patent holder alleges that the "machine learning platform uses one or more apparatuses, methods, program products, and systems covered by the patent." *Purepredictive, Inc., v. H2o.Ai, Inc*., Case No. 17-cv-03049-WHO. (N.D. Cal. 2017).

[8] In the Future of A.I. Act of 2017, Congress defines (Sec. 3 H.R. 4625):

(1) Artificial Intelligence. The term "artificial intelligence" includes the following:

Based on this definition, AIs could mimic innovative or creative patterns. In other words, AIs could create new knowledge in the form of inventions or works of arts. This AIs created knowledge would be one step removed from the AI-creation. This knowledge would be a second-generation knowledge. This second-generation knowledge would benefit society. AI-created knowledge would however be under-supplied because, like all knowledge, AI-created knowledge would be non-rival and non-excludable.

In the current US system, knowledge creation is incentivized through an intellectual property (IP) system. The IP system incentivizes knowledge[9] creation by providing the knowledge creator with a period of exclusivity. This article investigates whether, in the United States, such period of exclusivity should exist for AI-created knowledge. If so, this article attempts to answer who should own the IP created by AI machines. To answer these two questions, this article adopts a legal point of view focusing on the US system and an economics points of view. This article works backward: it answers the second question to be able to answer the first.

The second question requires investigating all the entities that participate in AI-created knowledge. AI-machines are evolving: they are becoming more sophisticated and coming closer to what the scholars who coined the term had in mind. When creating knowledge, AI-machines usually involve four entities: the creator, the owner, the operator, and the machine itself.

These four entities usually interact in the following basic scenario. A creator invents the AI-machine. The machine may then be sold to a subsequent entity. This subsequent entity is the new owner. This new owner then may employ others entities or individuals to use the machine to create new knowledge. These individuals are the machine operators. They input information into the machine and direct its creative process. In some situations, these entities may overlap. For example, the creator can also be the owner and operator.

All four participants in this second-generation creative process could claim some ownership to the AI-created IP. From the legal side, this article discusses under current jurisprudence who has the strongest claim to the IP. From an economic perspective, this article discusses how assigning IP to any entity affects the other to participate in the creative process.

> (A) Any artificial systems that perform tasks under varying and unpredictable circumstances, without significant human oversight, or that can learn from their experience and improve their performance. Such systems may be developed in computer software, physical hardware, or other contexts not yet contemplated. They may solve tasks requiring human-like perception, cognition, planning, learning, communication, or physical action. In general, the more human-like the system within the context of its tasks, the more it can be said to use artificial intelligence.
> (B) Systems that think like humans, such as cognitive architectures and neural networks.
> (C) Systems that act like humans, such as systems that can pass the Turing test or other comparable test via natural language processing, knowledge representation, automated reasoning, and learning.
> (D) A set of techniques, including machine learning, that seek to approximate some cognitive task.
> (E) Systems that act rationally, such as intelligent software agents and embodied robots that achieve goals via perception, planning, reasoning, learning, communicating, decision making, and acting.
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> (2) Artificial General Intelligence. The term "artificial general intelligence" means a notional future artificial intelligence system that exhibits apparently intelligent behavior at least as advanced as a person across the range of cognitive, emotional, and social behaviors.
> (3) Narrow Artificial Intelligence. The term "narrow artificial intelligence" means an artificial intelligence system that addresses specific application areas such as playing strategic games, language translation, self-driving vehicles, and image recognition.

[9] Knowledge is used in the broadest sense to describe any theoretical or practical understanding a subject. Knowledge include patentable inventions from inventors, copyrightable works of arts from authors, as well as facts, information, and skills that may not be protectable by the IP system.

This paper argues that while current courts may grant some IP to the AI-operator, the default rule should be let AI-created IP to fall into the public domain.

To make this argument, the article is divided in three sections. Section 2 investigates the potential claims of the machine creators. This section develops in details the reasons why the AI-creator should be given protection for the second-generation knowledge. The section looks at what happens: (1) when a patented AI creates an invention; (2) when a copyrighted AI creates a work of art; (3) when a patented AI creates a work of art; (4) when a copyrighted AI creates an invention; (5) when a non-protected AI creates an invention; and (6) when a non-protected AI creates a work of art.

To avoid repetitions, section 3 looks more cursorily at the claims that AI-machine owners, AI-operators, and the AI itself may have over the AI-created IP. Section 3a investigates the claims from AI-machine owners. Section 3b investigates the claims from AI-machine operators. Section 3c investigates the claims from the AI-machines themselves.

Section 4 discusses the strength of each claim. Under current laws and precedents, AI-machine operators have the strongest claim on AI-created patentable inventions but no one would be able to copyright AI-created works of art. From an incentive standpoint, granting rights to any party has negative effects on the incentives of others to participate in the knowledge creation process. This theoretical discussion cannot demonstrate that anyone has the least negative effect. In fact, this effect may depend on the situation – so much so that letting the IP falls into the public domain may be the best solution. The different parties would be incentivized to use contracting and alternative business models to profit from the AI's creation.

Ryan Abbott considered similar questions in the UK context and other jurisdictions.[10] He argues in favour of protecting computer-generated works. He argues that the author would always be contentious and that protection would help incentivize the programmers behind the machines. By contrast, I focus on the US and pushes the policy and economic arguments further and arrives at a different conclusion. But, we both agree that more clarity is required in this space – whether in the US (or the UK).

2 THE MACHINE CREATOR

The creator of the AI machine has a strong claim to the AI-created knowledge: *but-for* his or her work, the AI would not exist and nor would the AI-created knowledge. Therefore, incentivizing the AI creators should be essential for policymakers.

The following section discusses the debate around granting rights to the machine creator for the AI created IP. In the discussion, the AI-creator is assumed to not be the one owning or operating the AI. Those questions are dealt with in Section 3.

The first part of this section discusses whether machine creators should be granted patents over the invention created by their patented AI. The second part of this section discusses whether AI-creators should be granted copyright over the works created by their copyrighted AI. The third part of this section discusses whether the answer changes: (1) when the AI-creator patented the AI, which then creates a work of art; and (2) when the AI-creator copyrighted the AI, which then creates an invention. The fourth part of this section assumes that the AI cannot be protected and questions whether the AI-creator could get protection for the second-generation knowledge.

a. Patented AI & Second-Generation Innovations

[10] *Artificial Intelligence, Big Data and Intellectual Property: Protecting Computer-Generated Works in the United Kingdom*, Research Handbook on Intellectual Property and Digital Technologies (Tanya Aplin, ed. Forthcoming 2019) available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3064213

AI machines are often a combination of software and hardware. This section assumes that the original AI is patentable[11] and patented. At first, the second-generation innovations are assumed to be patentable. This section discusses whether the AI creator should be granted protection for the AI-created inventions. Then, this section discusses whether the second-generation innovation should be patentable.

From a policy standpoint, the creator could argue that he or she should be efficiently incentivized. The AI-creator designed its AI to generate new inventions. These inventions confer benefits on society. If the AI-creator does not internalize these benefits, she or he would not be efficiently incentivized to create the AI in the first place. To ensure the creation of the AI, the creator must be efficiently incentivized.[12]

The current IP system incentivizes bonified inventors by granting them a right to exclude others from using the knowledge they create. Exclusion enables IP holders to attempt to collect supra-competition returns on knowledge. Under the current IP system, AI-creators could argue that they should receive the right to exclude others from using the second-generation knowledge to ensure the first-generation AI is created.

This argument played a central role in *Bowman v Monsanto*.[13] In this case, Monsanto held a patent for herbicides resistant soybean seed.[14] After buying these seeds from Monsanto, a farmer decided to buy crops from a community grain elevator and use this grain as seeds for his following harvest.[15] The grain from the community elevator were mostly soybean with the patented trait because most farmers in the area used Monsanto seeds as well.[16] The US Supreme Court ruled that the farmers could not use the soybean from the community grain and raise them as crops because it amounted to a replication of the patented technology.[17]

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[11] Some inventors face uphill battles to prove innovativeness in an attempt to cast a broad net. For example, in *Blue Spike, LLC v. Google Inc.*, patents were invalidated because they attempted to claim protection for a method of signal recognition, which were considered abstract ideas and lack inventive concept. Google argued that signal comparison mirrors human perception and such a patent would block future breakthrough in artificial intelligence. 2015 WL 5260506 (N.D. Cal. 2015) affirmed *per curiam* No. 2016-1054. Fed. Cir. (2016) cert' denied 137 S.Ct. 2246 (2017). In some cases, the AI-type research tools may not even be granted protection because they are just a research starting point. In *re Fisher*, 421 F. 3d 1365 (Fed. Cir. 2005) the USPTO refuse to grant a patent because the claim asserted are "starting points for further research." *Id*. at 1370. The patent amounts to a tool of unknown use without clear function and the invention has "not been researched and understood to the point of providing an immediate, well-defined, real world benefit to the public meriting the grant of a patent." *Id*. at 1376. In other words, the patent applicant attempted to patent a research area. "[A] patent is not a hunting license. It is not a reward for the search, but compensation for its successful conclusion. [A] patent system must be related to the world of commerce rather than to the realm of philosophy." *Id*. at 1375-76 quoting *Brenner v. Manson*, 383 U.S. 519, 535-536 (1966). Extrapolating to AI, its creator invented a tool that can be used for research. As an abstract research tool, this creator cannot gain protection over the research tool and its progeny or the area of research. Some have already discussed whether such AI could be patentable. See e.g., Peter M. Kohlhepp, *When the Invention Is an Inventor: Revitalizing Patentable Subject Matter to Exclude Unpredictable Processes*, 93 MINN. L. REV. 779 (2008).

[12] Incentives can take many forms. The discussion in this section focuses on the IP system create incentives through the right to excludes. However, policymakers have used other system to incentives innovators. For example, in the UK, the Parliament passed The Longitude Act of 1714. This Act created a monetary reward for the inventors that came up with a device that would help sailors estimate the longitude of their ships. See e.g., M. Diane Burton & Tom Nicholas, *Prizes, patents and the search for longitude*, 64 EXPLORATIONS IN ECON. HISTORY 21 (2017)(discussing the innovation impact of the Act). Inducement prizes can even be used as a complementary incentive to the patent system to direct innovation without depriving innovators of their patent rights. See e.g. Liam Brunt, Josh Lerner & Tom Nicholas. *Inducement prizes and innovation*. 60 J. INDUSTRIAL ECON. 657 (2012)(find that prizes impact patenting behavior and can help target technology sectors).

[13] 133 S.Ct. 1761 (2013)

[14] *Id*. at 1764.

[15] *Id*. at 1765.

[16] *Id*.

[17] *Id*. at 1768-69.

The Court argued that if the patent holder cannot control the use of second-generation seeds, the farmers who purchased the first-generation seed from Monsanto would then be free to sell their crop as seeds. Monsanto would have to compete with second-generation seeds. "[I]f simple copying were a protected use, a patent would plummet in value after the first sale of the first item containing the invention."[18] To counterbalance this second-generation price drop, Monsanto would have to increase the price for the first-generation and price out farmers from purchasing the patented seed. Furthermore, the US Supreme Court also argued that the technology in *Bowman* was self-replicating.[19] Planting and raising new crops amount to unlawfully duplicating the original technology.

Bowman creates a precedent that supports an AI-creator's claim to future AI-created IP. Like plants, AI machines can self-replicate and self-improve.[20] If the Court applied the *Bowman* logic to AI machines, it could extend the patent rights from the original AI to its progeny, the second-generation AIs. Without such guarantees, the AI-creator would compete with its consumers in the AI market. Without such guarantees, AI creator would not create the original AI because s/he would be under-incentivized to create an AI.

The AI creator may decide to respond to a lack of guarantees by increasing the price of the original AI. The AI creator would have to encompass the value of future knowledge and improved AIs when pricing its first sale. The AI creator may price out any potential buyers. If the price increased without eliminating demand, the demand could be so small that AI creators could not reach the economies of scale necessary to justify the initial investment. Without these economies of scale, the AI creators may not profit and hence may never invent the AI.[21]

Following *Bowman*, US courts could interpret the Constitutional intent behind the Patent and Copyright clause to mean that an AI-creator should be granted rights over AI-created IP "to promote the progress of science and useful arts."[22] The easier approach would be to change the legislation: if policymakers found that AIs provide socially beneficial services, then they may wish to let AI-creators control and benefit from the AI's progeny.

Bowman focuses on the original product market competition.[23] AIs could however invent in unrelated fields. Even if the inventions were in different fields, the argument to grant the creator protection over the second-generation knowledge remains unchanged. Faced with the question, the US Supreme Court may decide that if the AI creator is not granted control over the AI-created IP, then it may not be efficiently incentivized to create the original AI or

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[18] 133 S.Ct. at 1767-68.

[19] *Id*.

[20] "Probably a truly intelligent machine will carry out activities which may best be described as self-improvement. Some schemes for doing this have been proposed and are worth further study. It seems likely that this question can be studied abstractly as well." John McCarthy, Marvin L. Minsky, Nathaniel Rochester, and Claude E. Shannon. (1955). *A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence*, available at http://www-formal.stanford.edu/jmc/history/dartmouth/dartmouth.html or in 27 AI MAG. 12 (2006).

[21] Economies of scale play a central role in software like AI. Software involve large fixed cost (i.e., the Research and Development) and low marginal cost (i.e., the costs of copying a software). To be profitable, goods with large fixed cost and low variable costs must be sold at large volume to be privately optimal to develop. Rajiv D. Banker, & Chris F. Kemerer, *Scale economies in new software development*, 15 IEEE TRANSACTIONS ON SOFTWARE ENGINEERING 1199 (1989)(finding when economies of scales occur in new software development). Beside economies of scale based on volume, software inventors also benefit from other volume-based externalities such as network. Network externalities may increase the AI user's willing to pay a premium; but the price increase remains a concern.

[22] Patent and Copyright Clause of the Constitution. Article I, Section 8, Clause 8 (capitalization omitted).

[23] The cannibalisation of the primary market by the secondary market is known as the Coase Conjecture attributed to Ronald Coase who first discussed this issue in Ronald H. Coase, *Durability and monopoly*, 15 J. L. & ECON. 143 (1972).

may price out any potential buyers. This incentive problem is the *direct effect* of granting AI creator control of the AI's work product: the effect on willingness-to-sell.

Such an argument faces two legal counter-arguments: the patent exhaustion doctrine and claim limitations. Both arguments have their root in decreasing transaction costs for subsequent transactions and subsequent inventors.

First, the patent exhaustion doctrine could limit how AI creators control the machine work product. The patent exhaustion doctrine states that "[w]hen a patentee sells an item, that product 'is no longer within the limits of the [patent] monopoly' and instead becomes the 'private, individual property' of the purchaser."[24] The US Supreme Court adopted this doctrine because it feared that a system where a right holder could control the IP and its use once the embodiment was sold would impede commerce.[25] In other words, it would increase transaction costs in the IP market.

In the AI case, the US Supreme Court may fear that granting creators control over the second-generation IP would destroy the market for AI. If consumers cannot exploit the AI's work product because it belonged to the original IP holder, then few (or no) consumers would be willing to purchase such machine. This limited market for the AI would not sufficiently incentivize innovators to create the original AI. This incentive problem is the *indirect effect* of granting AI-creator control of the AI's work product: the effect on willingness-to-pay.

The seeds in *Bowman* did not raise the same problem because the progeny had other uses (i.e. end-consumer consumption). *Bowman* stands as the glaring exception to the long history of the patent exhaustion doctrine[26] so much so that the US Supreme Court limited its application. The Court affirmed in *Bowman* that "[o]ur holding today is limited — addressing the situation before us, rather than every one involving a self-replicating product."[27] Therefore, the US Supreme Court may not expend the ruling to AI machine.

Other cases support that the US Supreme Court may not extend the *Bowman* ruling to the AIs' progeny. Instead, the Court may decide to reinforce the patent exhaustion doctrine. AI machines are software protected by method patents.[28] The US Supreme Court rules on the replication of such a method in *Quanta Computer, Inc. v. LG Electronics, Inc.*[29] In this case, LG held a patent that it licensed to Intel.[30] Intel made chips that embodied the patented methods.[31] Quanta purchased the Intel chips and combined them with other chips where the whole system implemented LG's patented methods.[32] LG claimed that Quanta infringed on its patent because the non-licensed chips embodied the patented method.[33] The US Supreme Court ruled that the patent exhaustion doctrine applied to business methods. "The authorized

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[24] *Impression Products v. Lexmark International,* 137 S. Ct. 1523, 1526 (2017).

[25] Chief Justice Roberts traces its origin to 1628 England. *Impression Products v. Lexmark International,* 137 S. Ct. 1523, 1526 (2017). (stating that Lord Coke wrote that "if an owner restricts the resale or use of an item after selling it, that restriction 'is voide, because... it is against Trade and Traffique, and bargaining and contracting betweene man and man.'") Justice Thomas traces the first mention in Supreme Court cases to 1853 in *Bloomer v. McQuewan*. *Quanta Computer, Inc. v. LG Electronics, Inc.*, 128 S. Ct. 2109, 2115 (2008)(quoting *Bloomer v. McQuewan*, 14 How. 539, 549, 14 L. Ed. 532 (1853)).

[26] In *Bowman*, the defendant argued that "exhaustion should apply here because seeds are meant to be planted. The exhaustion doctrine […] typically prevents a patentee from controlling the use of a patented product following an authorized sale." 133 S.Ct. at 1768. See e.g., Garry A. Gabison, *Worldwide FRAND Licensing Standard*, 8 AM. U. BUS. L. REV. 139, 154-62 (2019)(discussing the patent exhaustion doctrine cases decided by the US Supreme Court).

[27] 133 S.Ct. at 1769.

[28] See e.g., *Blue Spike, LLC v. Google Inc.*, *supra* note 11.

[29] 553 US 617 (2008).

[30] *Id*. at 2114.

[31] *Id*.

[32] *Id*.

[33] *Id*. at 2114-15.

sale of an article that substantially embodies a patent exhausts the patent holder's rights and prevents the patent holder from invoking patent law to control postsale use of the article."[34]

The US Supreme Court may be persuaded that the AI case stands closer to *Quanta* than *Bowman*. In *Quanta*, the IP holder received a licensing fee for each machine but not each replication within the machine i.e. not each second-generation use of the method. Under *Quanta*, the US Supreme Court would rule that patent rights cannot be used to control subsequent use of the IP – even for method patents. Once an AI-creator legally sold its AI (or license its use without condition), the transaction exhausts its rights to control its use.

The US Supreme Court would have to balance the *Bowman* ruling against the *Quanta* ruling. Specifically, it would have to balance the direct effect on AI creation against the indirect effects on AI consumption. The AI creators could address these issues more easily through licensing scheme than using patent right to control the use of AI and second-generation knowledge.

Second, creators may not be able to patent the second-generation inventions for two reasons: (1) the claim description in the first-generation patent limits what is protected;[35] and (2) the second-generation innovations must overcome the obviousness[36] hurdle during the patent applications. These criteria – among others – limit what is patentable. The claim description looks at the boundaries of what is claimed whereas the second look at foreseeable improvements; but, in the AI context, they both limit what second-generation knowledge could be protected.

Patents are public option contracts between society and the right holder.[37] For the contract to be formed, the right holder must create an invention where the benefits to society outweigh the costs. The benefits to society take the form of a new invention and advancing knowledge. The costs take the form of exclusivity-induced decreased competition and increased prices. Society can decide whether to take the option after learning about the invention's content.[38]

To advance knowledge, patents must describe and disclose the underlying invention "and of the manner and process of making and using it, in such full, clear, concise, and exact terms."[39] In other words, patent claims must be precise and the described invention must be reproduceable.[40] The claim descriptions must be sufficient to allow a person with ordinary skills in the art to repeat the process.[41] These claim descriptions set the boundaries of the patent's reach.[42]

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[34] *Id*. at 2122.

[35] 35 U.S. Code § 112.

[36] 35 U.S. Code § 103.

[37] The US Supreme Court has referred to patent as "public franchise." *Oil States Energy v. Greene's Energy Group*, 138 S. Ct. 1365, 1373-74 (2018). As such, the US Patent and Trademark office can revoke an already granted patent through its administrative process. Patents are not rights akin to property right that demand a review from Article III courts under the Seventh Amendment.

[38] To be patentable, an invention must (1) cover a patentable subject matter (35 U.S.C. § 101) and are (2) novel (35 U.S.C. § 102), (3) non-obvious (35 U.S.C. § 103), and (4) useful (35 U.S.C. § 101). With the USPTO as its agent, society decides whether to take the option i.e. pay the cost to receive the benefits.

[39] 35 U.S. Code § 112.

[40] 37 CFR 1.75.

[41] For example, *Nautilus, Inc. v. Biosig Instruments, Inc.,* 134 S. Ct. 2120 (2014) the Federal Circuit judges disagreed whether the patent sufficiently described the space between two electrodes to measure the machine user's heartrate. *Id*. at 2131. The US Supreme Court remanded for further determination not before stating that a patent is invalid for indefiniteness "if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Id*. at 2124.

[42] "Every patent is required to end with at least one claim. Claims are single sentences in which the patentee is required, by statute, to particularly identify the invention over which she wants exclusivity." Christopher A. Cotropia, *What is the "Invention"?*, 53 WM. & MARY L. REV. 1855, 1865 (2012). For example, in *Phillips v.*

To gain protection based on the original AI patent, the creator would have to somehow sufficiently and precisely described what his or her AI were to create. In other words, the AI creator would have to predict its AI's innovation. If he could predict its AI's innovation, then it should include this language into the original AI patent. As such, the question would become moot because the creator would already have a patent covering the follow-on innovation in the original patent.

In most cases, the AI-creator may fail to predict what the AI would invent. Without such prediction, the patent would not include sufficient and precise language in the original patent. Without such language, the creator would have to write a vague patent trying to claim follow on innovations. She or he would not be able to obtain a patent because it would be too abstract[43] – even under the machine test.[44]

Regardless of whether the AI creator can anticipate the AI's work. The invention itself may be unpatentable as obvious. Patent law attempts to ensure that only socially welfare enhancing patents are granted. To reach that aim, patent law proxies a cost-benefit analysis through four main criteria including[45] obviousness.[46]

Obviousness refers to advancement of knowledge. The advancement must be sufficient to be patentable. To be non-obvious, an invention cannot be anticipated by "a person having ordinary skill in the art" (POSITA) from known inventions.[47] But any POSITA with an AI could input the same information into the AI and obtain the same AI-generated inventions. So, the AI-generated inventions may not be considered an advancement. The AIs themselves make the second-generation inventions easier to anticipate for anyone using an AI.[48]

AWH Corp., 415 F.3d 1303 (Fed. Cir. 2005), the Federal Circuit debated the scope of the patent within the meaning of the word "baffle" to establish the patent's scope. The Federal Circuit adopted the plain meaning of baffle and as such reversed the summary judgment of noninfringement. *Id*. at 1328.

[43] *Alice Corp. Pty. Ltd. v. CLS Bank Intern* 134 S. Ct. 2347 (2014)(ruling that an abstract idea does not become patentable because it involves a computer implementation).

[44] While AI involves a machine and as such, patent holder may find a way to patent their invention under the machine test. *Bilski v. Kappos*, 561 U.S. 593 (2010)(discussing the machine-or-transformation test as one of the tests to determine the patentability of a method). The ideas that AI invention may try to protect may be too abstract as in *Blue Spike, LLC v. Google Inc.*, 2015 WL 5260506 (N.D. Cal. 2015). Others have discussed whether artificial intelligence should be patentable See e.g., Peter M. Kohlhepp, *When the Invention Is an Inventor: Revitalizing Patentable Subject Matter to Exclude Unpredictable Processes*, 93 MINN. L. REV. 779 (2008).

[45] To be patentable, the invention must (1) cover a patentable subject matter (35 U.S.C. § 101) and be (2) novel (35 U.S.C. § 101), (3) non-obvious (35 U.S.C. § 103), and (4) useful (35 U.S.C. § 101). Those criteria are vague and often proxy poorly the cost-benefit analysis. The system grants exclusivity to welfare reducing inventions (false positive) and denies exclusivity to welfare enhancing inventions (false negative). AI may create both welfare enhancing and reducing inventions.

[46] "A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made." 35 U.S.C. § 103.

[47] In *KSR International Co. v. Teleflex Inc*., 127 S. Ct. 1727 (2007), Teleflex was the exclusive license for a patent for an electronic sensor; Teleflex claimed that KSR infringed its patent because it used a similar sensor; KSR claimed the infringed claim was invalid because it was obvious: it was a predictable use of the prior art. The US Supreme Court ruled that the patent was obvious because it combined established prior art in a way obvious to a person with ordinary skill in the art. *Id*. at. 1742-45.

[48] See e.g., *Schering Corp. v. Geneva Pharmaceuticals*, 339 F. 3d 1373 (Fed. Cir. 2003)("Anticipation does not require the actual creation or reduction to practice of the prior art subject matter; anticipation requires only an enabling disclosure."). AI come in a number of forms. The most commons are artificial general intelligence and narrow artificial intelligence. See definitions from the Future of A.I. Act of 2017, *supra* note 8. Because narrow AI accomplishes a limited set of tasks, it is more likely to create a predictable invention because the creator created the AI for the particular purpose. By contrast, artificial general intelligence resembles more a human intelligence which makes the predicting inventions more difficult.

Furthermore, the fictional POSITA may need to be adjusted because of the existence of AIs. As AI machines become more ubiquitous, the standard may need to become a "person having ordinary AI-enhanced skill in the art." Such an enhanced POSITA would mean that AIs could make any inventions more obvious and less likely to be patentable.

In conclusion, patent doctrines and existing precedents weigh against granting AI-creators rights over the AI created IP. Economic reasoning shows that granting AI-creators rights over the AI created IP would incentivize AI-creators while disincentivizing AI purchasers and users. The balance of incentives weigh against AI-creators as they can deploy other business models to profit. The next section investigates what happens with respect to copyrighted AI and the copyrightability of their works of art.

b. Copyrighted AI & Second-Generation Works

Most AI machines have software and hardware components. The AI software can be protected through copyright. This section assumes that the original AI software is copyrighted. It also assumes that the second-generation works of arts are copyrightable. This assumption is relaxed below. This section discusses whether the AI creator should be granted copyright protection for the AI-created works.

When designing copyright policy, policymakers must balance countervailing incentives similar to the ones generated by patent rights. On the one hand, policymakers weigh whether protecting and assigning the AI-generated IP to an AI-creator is necessary to incentivize the creation of AIs or their market. On the other hand, policymakers weigh whether this protection and assignment would dis-incentivize all consumers to purchase the AI or operators to use the AI to create new knowledge. The opposing incentives create a vicious circle.

In copyright law as in patent law, policymakers have generally favoured consumers' incentives to purchase over authors' incentives to create. Policymakers have worried that extending the reach of copyright holders increase transaction costs. These costs would impede more than benefit commerce. This balance led to the creation of the first sale doctrine.

The first sale doctrine is the copyright parallel to the patent exhaustion doctrine.[49] These two doctrines serve a similar purpose.[50] Its common-law history also reaches as far back as the patent exhaustion doctrine.[51] The first sale doctrine limits the copyright holder's ability to control the goods embodying the copyrighted works.

The Court created the first sale doctrine because it feared that, otherwise, copyright holders could dictate and limit what would happen to copyrighted works even once they entered the stream of commerce.[52] Congress later codified the common law in the Copyright Act of 1976.[53] The codified doctrine specifies that "the owner of a particular copy […] lawfully made

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[49] Garry A. Gabison, *The First Sale Doctrine and Foreign Sales: The Economic Implications in the US Textbook Market*, 15 UMASS L REV (Forthcoming 2019)(discussing in more details case law related to the first sale doctrine).

[50] "The two share a 'strong similarity ... and identity of purpose.'" *Impression Products v. Lexmark International,* 137 S. Ct. 1523, 1526 (2017) quoting *Bauer & Cie v. O'Donnell*, 229 U.S. 1, 13(1913).

[51] *Kirtsaeng v. John Wiley & Sons, Inc.*, 133 S. Ct. 1351, 1363 (2013). Justice Breyer traces it to 1628 England. "In the early 17th century Lord Coke explained the common law's refusal to permit restraints on the alienation of chattels … A law that permits a copyright holder to control the resale or other disposition of a chattel once sold is similarly 'against Trade and Traffi[c], and bargaining and contracting.'" The US Supreme Court precedents first discuss the doctrine in 1908 in *Bobbs-Merrill Co. v. Straus*, 210 US 339 (1908). In this case, the copyright holder attempted to impose a resale price maintenance based on its copyright and ability to control the copyrighted books. *Id*. at 340.

[52] "The whole point of the first sale doctrine is that once the copyright owner places a copyrighted item in the stream of commerce by selling it, he has exhausted his exclusive statutory right to control its distribution." *Quality King Distribs., Inc. v. L'anza Research Int'l, Inc.*, 523 U.S. 135, 152 (1998).

[53] 17 U.S.C. § 109.

[…] is entitled, without the authority of the copyright owner, to sell or otherwise dispose of the possession of that copy."[54]

The Congressional version of the first sale doctrine makes special mention of software. This version specifies how software ought to be handled. First, the doctrine does not apply to software rental, lease, or lending for commercial purpose. The first-generation copyright holder retains its rights unless the transfer involves "a nonprofit educational institution."[55] In commercial context, the first sale doctrine encourage an AI-creator to use a licensing scheme to exercise control over the software use – but copyright law cannot be asserted to control its use.

Second, a software sale does not hinder a copyright holder's ability to control reproduction of the AI-software.[56] This ability to control reproduction reflects the worry that software can be cheaply copied to compete with the original. Copyright law provides an avenue for AI-creator to rein in competition from direct or autonomous reproduction.

Right holder can also control some reproduction of second-generation knowledge. For example, based on the assumed definition, an AI can self-ameliorate its code. The first-generation right holder can exclude others from using the AI-code that comes from the original software. That portion of the code remains protected. Thus, right holders could prevent second-generation AIs from being created.

Questions remain about the portion of the code that the AI has generated. Pushing this further, AIs could create works of art unrelated to the AI software. An inventor could create an AI software and copyright it. This AI could subsequently write a software, a book, a poem, or a symphony. For example, an AI-software can paint a picture.[57] This painting may include some independent improvisations.[58]

Copyright law provides no support to allow AI-creators to control this work of improvisation. The statute states that right holders cannot control "a computer program which is embodied in a machine or product."[59] Congress worried about copying and not about the use or work product once the software-embodied in a machine was sold.

In conclusion, policymakers – as well as courts – have favoured other business models such as licensing over extending copyright law. While policymakers may not have anticipated the use of AI to create works of arts, they favoured a Copyright Law that enables the dissemination of works. Assigning the AI-generated IP to creators would impede on the dissemination of their AI. As such, policymakers would not favour such right extension.

So far, this section assumes that the AI word product would be copyrightable and focus on the assignment issue. However, this work product may not be copyrightable.[60] To be a copyrightable a work must be original. "The *sine qua non* of copyright is originality."[61] Originality ensures that the benefits to society outweigh the costs. As in patent protection, the benefits to society is the creation and dissemination of new works whereas the costs take the form of supra-competitive price due to right to exclude others. Originality attempts to proxy this balance.

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[54] 17 U.S.C. § 109(a).
[55] 17 U.S.C. § 109(b)(1)(A).
[56] 17 U.S.C. § 109.
[57] See e.g., Jonathan Jones, *A portrait created by AI just sold for $432,000. But is it really art?*, GUARDIAN (Oct. 26, 2018) https://www.theguardian.com/artanddesign/shortcuts/2018/oct/26/call-that-art-can-a-computer-be-a-painter
[58] See e.g., Nadja Sayej, *Vincent van Bot: the robots turning their hand to art*, GUARDIAN (Apr. 19, 2016) https://www.theguardian.com/artanddesign/2016/apr/19/robot-art-competition-e-david-cloudpainter-bitpaintr
[59] 17 U.S.C. § 109(b)(1)(B)(i).
[60] To be copyrightable, a work must be (1) original, (2) fixed in (3) any tangle medium of expression (17 U.S. Code § 102). The discussion focuses on the first element and assume the other are satisfied.
[61] *Feist Publications, Inc. v. Rural Telephone Service Co.*, 499 US 340, 345 (1991).

"To qualify for copyright protection, a work must be original to the author."[62] The US Supreme Court stated that "[o]riginal, as the term is used in copyright, means only that the work was independently created by the author (as opposed to copied from other works), and that it possesses at least some minimal degree of creativity."[63] These criteria provide more details proxy for courts to investigate the societal balance of interests. First, "independently created" – as opposed to copied – ensures that protection is not granted to a work for which society already enjoys the benefits. Granting further protection to another copy of the same work would generate no benefits. Second, "minimal degree of creativity" ensure that the gap between current knowledge and the new knowledge is sufficient to warrant exclusivity. In other words, this criterion ensures that the marginal benefit to society (additional creative work) outweigh the marginal cost (new protection for a work).

In the AI context, most works would not be copyrightable. First, AI-created IP may not be considered independently created. By assumption, the AI-creator would need to involve an operator and the AI. The AI-creator may not be considered the "author" and she or he would not be independent because it requires the help of the operator and AI – if it were to be considered an entity. Whether the AI-operator or the AI itself have a claim is discussed in more details below in section 3.

Second, AI-created IP may not involve a minimal degree of creativity. Once an AI-creator makes his or her machine, the machine can be duplicated. Any duplicated machine which received the same instructions should reach a similar outcome. Thus, the work product would not be unique to the machine. Even if the machine has an element of randomness to it, the differences may not be substantial enough to justify granting protection i.e. the costs would outweigh the benefits.

Thus, both copyright law and the aims of copyright law would not favour AI-creators being granted and assigned protection for their AI works of arts. The next section discusses what happens when right holders try to cross protection between patent and copyright.

c. Mixing Intellectual Property Protection

This section looks at the next two issues with AI-created innovations and works: (1) whether copyright protection should be granted and assigned to AI-patent holders for the AI-created works;[64] and (2) whether patents should be granted assigned to AI-copyright holders for the AI-created inventions.[65] This mix protection avoid issues of foreseeability but do not foreclose issue of originality. This section discusses whether AI-creator should be granted the second-generation knowledge by discussing the aims of the IP system.

In the US, patent right and copyright protection do not originate from common law[66] or human right.[67] The IP system originates from the Constitution. The Constitution states that the IP system aims "[t]o promote the progress of science and useful arts, by securing for limited

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[62] *Id.*
[63] *Id.*
[64] This question is discussion in more details in other works. See e.g., Timothy L. Butler, *Can a Computer be an Author – Copyright Aspects of Artificial Intelligence*, 4 COMM/ENT L.S. 707 (1981). Daniel J. Gervais, *The Machine As Author*, 105 IOWA L. REV. (Forthcoming 2019).
[65] The fact that the patent was obtained through a copyright AI should not be problematic. "Patentability shall not be negated by the manner in which the invention was made." 35 U.S. Code § 103.
[66] *Wheaton and Donaldson v. Peters and Grigg*, 33 US 591, 661 (1834).
[67] The view that copyright is part of the human right is common in other parts of the world. For example, the Universal Declaration of Human Rights states "[e]veryone has the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author." General Assembly Resolution 217, Art. 27(2) (1948) available at https://www.un.org/en/universal-declaration-human-rights/

times to authors and inventors the exclusive right to their respective writings and discoveries."[68] This clause has required Legislative and Judicial interpretations.

Promoting by securing an exclusive right can take many forms. Promoting could be interpreted to mean that this exclusive right should be granted when a rational AI-creator is efficiently incentivized. Such incentives occur if the creator expects that its benefits outweigh its costs. However, the US Supreme Court has rejected this creator-centric cost-benefit analysis.

Specifically, in copyright law, the US Supreme Court has rejected the cost approach.[69] This approach was embodied in the "sweat of the brow" doctrine. This doctrine granted copyright protection for works that had required efforts to create.[70] The Court moved away from this doctrine because the Court viewed the doctrine as protecting both facts and their arrangements.[71] The Court re-affirmed that facts were not protected and hence fact compilations should not be protected either – even if they were costly to create.[72]

In patent law, Congress affirmed that "[p]atentability shall not be negated by the manner in which the invention was made."[73] According to this statute, the manner – including the costs – becomes irrelevant to the determination of patent protection.

The rejection of the inventor-centric approach benefits AI-creator in protecting second-generation knowledge. The second-generation knowledge could receive protection even with minimal involvement or investment from the creator. Thus, even if the second-generation knowledge was a by-product of the first-generation knowledge, AI-creator may have a claim.

From a policy standpoint, rejecting the inventor or author-centric approach has upside and downsides. On the one hand, this rejection encourages AI-creators to focus on commercial reward instead of social value.[74] It could leave society without solutions for problems which cannot be solved through commercially viable models (e.g., war against peace). In the AI-context, it could over-incentivize creators to develop AIs that would autonomously generate

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[68] Patent and Copyright Clause of the Constitution. Article I, Section 8, Clause 8 (capitalization omitted).

[69] Even though the US Supreme Court has rejected it, it has also struggled with this doctrine. In *International News Service v. Associated Press*, 248 U.S. 215 (1918) the Court refused to grant a copyright in the news but create a "quasi-property" because it recognized that without some protection, the news producer would not be able to recoup their cost. "That business consists in maintaining a prompt, sure, steady, and reliable … at a price that … is sufficient in the aggregate to afford compensation for the cost of gathering and distributing it, with the added profit so necessary as an incentive to effective action in the commercial world." *Id*. at 235. But, in *Feist Publications, Inc. v. Rural Telephone Service Co*., 499 US 340 (1991) the plaintiff complied information into telephone listing database. The defendant copied some information from the listing. The Court rejected the sweat of the brow doctrine because "it extended copyright protection … to the facts themselves." *Id*. at 352-53.

[70] "Known alternatively as 'sweat of the brow' or 'industrious collection,' the underlying notion was that copyright was a reward for the hard work that went into compiling facts." *Feist Publications, Inc. v. Rural Telephone Service Co*., 499 US at 352.

[71] The US Supreme Court stated in *Eldred v. Ashcroft*, 537 US 186 (2003), that the "sweat-of-the-brow view of copyright, however, was emphatically rejected by this Court in 1834 in *Wheaton v. Peters*." *Id*. at 236. The Court reasoned that copyright was not a Constitutional right but a Congressional creation. As such, it could be removed, changed or amended. Copyright was not automatic from a having expended cost. Nonetheless, the Court explicitly rejected this doctrine in *Feist Publications, Inc. v. Rural Telephone Service Co*. "The 'sweat of the brow' doctrine had numerous flaws, the most glaring being that it extended copyright protection in a compilation beyond selection and arrangement—the compiler's original contributions—to the facts themselves." 499 US at 352.

[72] *Id*.

[73] 35 U.S. Code § 103.

[74] This issue has led to Congress having to carve out specific incentives when the social benefits outweigh the commercial benefits. For example, Congress passed the Orphan Drug Act of 1983, which attempts to incentivize pharmaceutical companies through broader exclusivity (i.e. exclusivity of disease treatment instead of molecule) and more tax credit to create drugs for rare diseases. See e.g., David Duffield Rohde, *The Orphan Drug Act: An Engine of Innovation – At What Cost*, 55 FOOD & DRUG L.J. 125, 144 (2000).

knowledge. While this knowledge could have commercial applications, the AI-creator could receive protection to rent-seek e.g., anticipate competitive entry.

On the other hand, rejecting the innovator-centric approach encourages inventors and authors to be efficient. First, these individuals control development costs. The investments may affect the AI's quality. It also affects the number of applications. Some of these applications are foreseeable and others are unforeseeable. Granting the AI-creator protection for foreseeable applications creates efficient incentives. It influences the investment and exploitation level. Granting the AI-creator protection for unforeseeable revenue stream would not incentivize the innovation. Rejecting the inventor/author-centric approach rewards luck instead of investment.

Granting protection for foreseeable and unforeseeable second-generation knowledge removes uncertainties about revenue apportionment. It gives the AI-creator a better bargaining position when negotiating with other potential claimants. It decreases the number of disputes related to authorship. For example, if a creator sells an AI to two different users and these users reach the same outcome, all claims revert to the creator without unnecessary disputes.

However, this grant could also create more disputes. AI could decrease innovation costs and decrease the leaps in innovation. Multiple creators may try to claim protection for similar or close work product. These claims could blur the boundaries between different work product.[75] This phenomenon would increase uncertainties about the revenue stream. AI-creators may not be more incentivized even if they were guaranteed protection for the second-generation knowledge because they could not anticipate those innovations (and revenue streams).

Second, the AI-creators also control – to some extent – the benefits they receive. The AI-creators do not need to rely on the revenue stream from second-generation knowledge because, by assumption, the original AI is protected from perfect competition and they control its pricing. The AI creator can increase the price of the AI sale to reflect the value of the second-generation knowledge. If the price raise decreases the creator's profit, this creator can resort to other business models (e.g., licensing, metering, time limit, contractual royalty on subsequent IP).[76] These models avoid releasing the AI into the stream of commerce: the creator

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[75] In theory, the obviousness requirement in patent and the originality requirement in copyright should filter out these IP. But, this is not always the case. In the patent context, some patent may have overlapping claims. *See e.g.*, Georg Graevenitz, Stefan Wagner, & Dietmar Harhoff, *Incidence and growth of patent thickets: The impact of technological opportunities and complexity*, 61 J. INDUSTRIAL ECON. 521 (2013)(finding that patent thicket occur more in complex technologies where patents cite each other more and hence when an invention requires more patents to be implemented). Instead of filtering similar system, these overlaps mean that more cooperation becomes necessary in complex technology. These overlaps have been referred as the "patent thicket." Carl Shapiro, *Navigating the patent thicket: Cross licenses, patent pools, and standard setting*, 1 INNOVATION POL. & ECON. 119 (2000).

[76] Contracts may constitute the best avenue of recovery to receive sufficient financial incentive. The US Supreme Court has expressed that contracts may be a better avenue of recovery than patent law. For example, in *Quanta*, the US Supreme Court made clear that LG could raise a contract claim but did not express an opinion on the validity of the claim. *Quanta Computer, Inc. v. LG Electronics, Inc.*, 553 US 617, fn. 7 (2008)(stating that "LGE's complaint does not include a breach-of-contract claim, and we express no opinion on whether contract damages might be available even though exhaustion operates to eliminate patent damages")(citation omitted). Contracts raises their own problem. Contracts are often incomplete and AI creators may not foresee how the AI will be used or how the AI users may try to escape their contract obligation. In both *Quanta* and *Bowman*, the plaintiffs had their direct costumers sign contracts in an attempt to control how their product was used. In *Quanta*, LGE licensed a patent portfolio to Intel Corporation. The License Agreement "permits Intel to manufacture and sell microprocessors and chipsets that use the LGE Patents (Intel Products). The License Agreement authorizes Intel to 'make, use, sell (directly or indirectly), offer to sell, import or otherwise dispose of' its own products practicing the LGE Patents." Quanta Computer, Inc. v. LG Electronics, Inc., 553 US 617, 620 (2008). In *Monsanto*, "Monsanto sells, and allows other companies to sell, Roundup Ready soybean seeds to growers who assent to a special licensing agreement." *Bowman v. Monsanto Co.*, 133 S. Ct. 1761, 1764 (2013). "And so Monsanto,

does not face direct competition in the original AI market.[77] These models could ensure that the creator profits from the second-generation knowledge without having to extend current IP rights. If these models do not incentivize creators, these creators should consider exploiting their AIs in-house. In-house exploitations ensure that an AI-creator can harness the first mover advantage[78] – a frequently preferred avenue of profiting from IP.[79]

Patent and copyright law ignores inventor-author's cost-benefit analysis because those individuals control both costs and benefits. Instead, the IP system focuses on society's analysis. Society should grant IP protection for AI-created innovations and works if those would not exist without protection and if their existences benefit more than cost society.

The IP system can incentivize knowledge creation but it cannot incentivize unforeseeable leaps in knowledge. Therefore, the IP system should not grant irrational AI-creators protection for the second-generation knowledge; nor should the IP system help creators who fail to price correctly their invention.

Some of these alternative business models disappear if the original AI cannot be protected. The next section discusses the issue when non-protected AI are used to create second-generation knowledge.

d. From No Protection to Some Protection

In some cases, AI-machines may not be protectable.[80] Even if they are protectable, some creators may not want to protect their AIs through the IP system. When Congress created the IP system, it did not create a self-enforcing right. Instead, right holders had to enforce these rights and pursue alleged trespassers. These rights are often expensive to enforce.[81] Thus, some AI-creators may prefer to use trade secret to protect their AIs.[82]

Relying on trade secret creates different issues. Relying on trade secret decreases creators' ability to profit. Creators cannot sell their AI without risking the machine being copied. Creators may need to be incentivized to create their AI. Creators could be incentivized by being assigned protection for their second-generation knowledge. They may be able to monetize the AI's progeny.

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predictably enough, sells Roundup Ready seed to farmers with a license to use it to make a crop." *Id*. at 1768. These contracts reveal a desire to control their IP beyond what patent law authorized. In both cases, the lawsuits arose because the contracts fail to foresee how IP users would attempt to avoid patent liability. Contracts may also be less incentivizing than patent law because they do not allow punitive damages. AI creator may favor patent law because they allow for treble damages for willful infringement. Under 35 U.S.C. § 284, courts "may increase the damages up to three times the amount found or assessed." In *Halo Electronics, Inc. v. Pulse Electronics*, 136 S. Ct. 1923 (2016), the US Supreme Court found that "Section 284 allows district courts to punish the full range of culpable behavior. […] Consistent with nearly two centuries of enhanced damages under patent law, however, such punishment should generally be reserved for egregious cases typified by willful misconduct." Arguably, these treble damages may be the difference between under and over-incentivizing.

[77] This issue is referred to as the Coase Conjecture. See fn. 23. Leasing is one of the ways to avoid the issues linked Barak Y. Orbach, *The Durapolist Puzzle: Monopoly Power in Durable-Goods Markets*, 21 YALE J. ON REG 67, 120 (2004).

[78] Marvin B. Lieberman & David B. Montgomery, *First-mover advantages*, 9 STRATEGIC MANAGEMENT J. 41 (1988)(discussing the advantages and disadvantages of moving first).

[79] Industry surveys show that practitioners prefer first mover advantage over patenting. See e.g. Richard C. Levin, Alvin K. Klevorick, Richard R. Nelson, Sidney G. Winter, Richard Gilbert, & Zvi Griliches. *Appropriating the returns from industrial research and development*. 3 BROOKINGS PAPERS ON ECONOMIC ACTIVITY 783 (1987); Aija Leiponen & Justin Byma, *If you cannot block, you better run: Small firms, cooperative innovation, and appropriation strategies*, 38 RESEARCH POLICY 1478 (2009).

[80] See discussion in fn. 11.

[81] Garry A. Gabison, *Government-Sponsored Patent Monetizing Entities*, 12 J. BUS. ENTREPRENEURSHIP & L. 229, 262 (2019)(discussing the enforcement costs of patent rights).

[82] Some innovators prefer to rely on trade secret. They only patents once their innovations can be reversed engineered. Petra Moser, *Innovation without patents: Evidence from World's Fairs*, 55 J. L. & ECON 43 (2012)(showing that, in the chemical industry, inventors patented more after reverse engineering became easier).

Furthermore, relying on trade secret enhances the creator's claim to second-generation knowledge. It avoids issue of foreseeable from first-generation patents. It may avoid issues of originality if second-generation knowledge is considered undistinguishable from the first-generation AI.

When the AI is not protectable, creators may not be under-incentivized to create the AI. While they might not be able to sell or lease the AI for fear that the technology would be copied or become worthless,[83] they might decide to exploit it themselves. Exploiting the second-generation knowledge becomes one way to monetize the AI. These AI-creators may need to be incentivize to make an AI-machine by granting them protection for the AI-generated knowledge.

This incentive may nonetheless be unnecessary. First, AI-creators would still enjoy the first mover advantage in the second-generation knowledge space. Second, if trade secret is an option, creators should not be granted protection for second-generation knowledge for two reasons: (1) AI creators could still sell an unduplicable AI; and (2) AI-creators would then be able to extend protection to AI-generated IP by not protecting their AIs. This protection could harm more than benefit society because an AI may produce unforeseeable benefits, which would never had incentivized AI creators.

Policymakers may not be able to distinction between voluntary and involuntary decision to use trade secret or between anticipated and unanticipated AI progeny. Protecting the second-generation is an inefficient approach to incentivizing AI. To be efficient, the AI-creators would have to be rational and form expected belief about the AI's future work product. If these AI-creators were able to anticipate what their AI would develop, they could protect it directly. Extending protection would only reward irrational AI-creators or luck. It would go again the ethos of the IP system.

3 MACHINE OWNER, MACHINE OPERATOR, AND THE AI MACHINE

"The economic philosophy behind the clause empowering Congress to grant patents and copyrights is the conviction that encouragement of individual effort by personal gain is the best way to advance public welfare through the talents of authors and inventors in 'Science and useful Arts.'"[84]

This US Supreme Court's view may prove complicated in the AI setting. AI involves a number of entities beyond the AI-creator. To encourage individual efforts requires a delicate balance. This section attempts to answer whether this balance can be reached to improve welfare. This section discusses the claims an AI-owner, an AI-user, and the AI itself may have over the AI-created IP. Many of the issues discussed about AI-creators apply to these other claimants. To avoid repetitions, this section focuses on the more important issues related to each claimant.

a. AI-Machine Owner

In many settings, machine creator, owner, and operator differ. This section assumes that the second-generation knowledge is protectable. It investigates whether AI-machine owners should be able to claim protection for the AI-generated knowledge.

A machine owner IP system would make the machine more valuable to owners. Assigning owners IP rights would increase demand for AI machines i.e. increased willingness-

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[83] Sometimes referred as the Arrow Information Paradox, the technology cannot be sold or discussed without having to disclose information about the technology. Disclosing the information eliminates the commercial value of the technology because any potential buyers that receive that information have the necessary knowledge to reproduce it. See Kenneth Joseph Arrow, *Economic welfare and the allocation of resources for invention*, THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS 609 (1962).

[84] *Harper & Row, Publishers, Inc. v. Nation Enterprises*, 471 US 539, 558 (1985) (quoting *Mazer v. Stein*, 347 U. S. 201, 209 (1954)).

to-pay and quantity demanded. This increased demand would increase returns to AI-creators on the first-generation knowledge.

However, a machine owner (or creator) right system would disincentivize users. By assumption, the owner differs from the user. For the AI to produce any knowledge, the owner must cooperate with a user. This relationship suffer from agency problems. The agency problem occurs because the beneficiary of the work (the owner) differs from the decision maker (the AI user).[85] This separation leads to a misalignment of incentives: the user would not use the AI to create second-generation knowledge at the socially efficient level because the user would not (fully) internalize the benefits of his or her work.

An owner IP system already exists in some jurisdictions. In the University context, the knowledge created within a university environment may belong to the researcher or the university by default. For example, in Austria, Denmark, Finland, and Norway, researchers were the default IP right holders[86] whereas in Germany, legislation moved away from a default researcher ownership toward a default university ownership.[87] A study found that assigning ownership to the lab owner decreased exploitation incentives.[88] This assignment likely has a similar effect on creation incentives.[89]

Regardless of the default, many universities negotiate those rights. Under different regimes, the institutes and the researchers negotiate different incentive schemes.[90] Among those, they may discuss bonus scheme to encourage research. Depending on the situation, lab owner may be better off relinquishing the IP to the researcher.[91]

In the AI context, an owner would have to address these agency problems. Regardless of the default IP rule, the AI-owner would have to negotiate with and incentivize the AI-users. Incentive contracts can take many forms such as outcome based (e.g., royalty or bonuses) or effort based (e.g., hourly salary).

These incentive contracts make the default ownership assignment redundant. On the one hand, if the AI-owner has default ownership, then it will have to negotiate with the AI-user to incentivize knowledge creation. On the other hand, if the AI-user has default ownership, then the AI-user has to negotiate with the AI-owner to incentivize access to the machine.

In other word, regardless of right assignment, an AI-owner has to negotiate with an AI-user. Contract remains the best way to assign the profits from AI-generated IP. This assignment depends on the bargaining position of AI-owners and users. Competition between

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[85] See e.g., Eugene F. Fama and Michael C. Jensen, *Separation of Ownership and Control,* 26 J. L. & ECON. 301 (1983)(discussing the issues associated with separating the decision maker from ownership).

[86] Gustavo A. Crespi, Aldo Geuna, Önder Nomaler & Bart Verspagen, *University IPRs and knowledge transfer: is university ownership more efficient?*, 19 ECON. INNOVATION & NEW TECH. 627, 629 (2010)("Some countries in Europe (Austria, Denmark, Finland, Germany, and Norway) traditionally had the so-called professor privilege, which gives university employees the IPR to their inventions. Most of these countries recently changed their legislation, assigning ownership to the university…").

[87] *Id.*

[88] Paola Giuri, Federico Munari & Martina Pasquini, *What determines university patent commercialization? Empirical evidence on the role of IPR ownership*, 20 INDUSTRY & INNOVATION 488 (2013)(discussing the different incentives beyond patent exploitation under different regimes and finding that legislative regime that grant university ownership of the researchers' IP are correlated with fewer sales but had no statistically significant impact on licensing and spin-off).

[89] Philippe Aghion & Jean Tirole, *The management of innovation*, 109 QUARTERLY J. ECON. 1185 (1994) (modeling and discussing the incentive impact of different intellectual property right regime and assignments of right).

[90] *Id*. fn. 1.

[91] "Giving property rights to the research unit is optimal when it is more important to encourage the unit's effort to discover than to boost the customer's financial (and nonfinancial) investment in the research." *Id*. at 1186.

AI-owners and users affect the bargaining position – not the default rule.[92] The next section focuses on the AI-users.

b. AI Machine Operator

Without the ability to negotiate, comparing an owner IP-ownership to a user IP-ownership, their incentives move in opposite direction. Assigning the IP to the owners incentivizes investments in AI-machines. Assigning the IP to the users incentivizes the exploitation of AI-machines.

From an incentive standpoint, assigning AI-users the machine created IP would lead to more inventions and works of art. Like the AI-creator, AI-users could argue that they are the proximate cause for the IP. The AI-users may even be a closer proximate cause because AI-machines may have substitutes but without the AI-users' input, the machine would not have discovered that invention or created that work. Regardless of the IP protecting the AI, these machines remain tools. In fact, the AI-user may have reached the same outcome but more slowly without the AI.

Based on current precedents, AI-users may have the strongest claim to the AI created IP.[93] In the patent context, an AI-user can patent a second-generation invention even if the invention was made by using patented tools or through serendipity.[94] The use of the AI to invention is irrelevant. Even if the second-generation invention is cumulative, it often is patentable.[95]

Patentability questions are fact intensive. Historically, a creative genius was necessary to make an invention patentable.[96] The US Supreme Court created the "flash of creative genius" test. This test required an inventor to show that an invention was useful and was the results of more than incremental steps from constant efforts.[97] The inventor had to show its creative mind and that something more than normal skills of the profession was applied to make the invention.[98]

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[92] This is specific restatement of the general Coase Theorem. First discussed in *The federal communications commission*, 2 J. L. & ECON. 1 (1959) and later illustrate with more examples in *The problem of social cost,* 3 J. L. & ECON. 1 (1960), Ronald Coase laid out that "It is necessary to know […] [the] initial delimitation of rights [for without it] there can be no market transactions to transfer and recombine them. But the ultimate result (which maximises the value of production) is independent of the legal position if the pricing system is assumed to work without cost". *Id.* at 8.

[93] The discussion focuses on AI users who have obtained the AI through legal means such as a sale or a license. If the AI user did not obtain the AI legally, then using the AI to create new knowledge raises liability issues. See e.g. Janice M. Mueller, *No Dilettante affair: Rethinking the experimental use exception to patent infringement for biomedical research tools*, 76 WASH. L. REV. 1 (2001); Donald R. Ware, *Research Tool Patents: Judicial Remedies*, 30 AIPLA Q J 267 (2002).

[94] "Patentability shall not be negated *by the manner* in which the invention was made." 35 U.S. Code § 103 (2011)(emphasis added).

[95] The AI-users may not be incentivized to develop cumulative innovation based on the AI because they may not be able to exploit it. Suzanne Scotchmer, *Standing on the shoulders of giants: cumulative research and the patent law*. 5 J. ECON. PERSPECTIVES 29 (1991)(discussing the difficult issue of setting breadth and depth of patents to incentivize cumulative innovation).

[96] The flash of creative genius test was formulated in *Cuno Engineering Corp. v. Automatic Devices Corp.*, 314 US 84, 91 (1941): "the new device, however useful it may be, must reveal the flash of creative genius, not merely the skill of the calling. If it fails, it has not established its right to a private grant on the public domain."

[97] David E. Wigley, *Evolution of the Concept of Non-obviousness of the Novel Invention: From a Flash of Genius to the Trilogy*, 42 ARIZ. L. REV. 581, 591 (2000).

[98] "Tested by that principle, Mead's device was not patentable. We cannot conclude that his skill in making this contribution reached the level of inventive genius which the Constitution (Art. I, § 8) authorizes Congress to reward. He merely incorporated the well-known thermostat into the old "wireless" lighter to produce a more efficient, useful, and convenient article." *Cuno Engineering Corp. v. Automatic Devices Corp.*, 314 US at 91.

However, the Copyright Act of 1952 moved away from the flash of genius test in favour of the non-obviousness criterion.[99] While different, both criteria require that "[m]ore must be done than to utilize the skill of the art in bringing old tools into new combinations."[100]

In the AI context, the creative genius test would nullify an AI-user's claim to second-generation invention.[101] The patenting decision would become a question of fact about the AI-user's involvement, input, and creative genius. Moving away from the creative genius test in favour of the obviousness requirement still leaves questions open.

The obviousness requirement could also nullify the AI-user's claim. As discussed, the fictional POSITA[102] depends on the tools available to him or her and the knowledge base at the time of filing.[103] Some scholars have argued that technology should affect the knowledge base and the POSITA standard.[104] Enhancing the POSITA standard to include AI tools could make everything more obvious because the AI-user would have to show that this AI-created invention was not obvious for others with their own AI-machine.[105]

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[99] Arthur H. Seidel, *The constitution and a standard of patentability*, 48 J. PAT. OFF. SOC'Y 5, 5-9 (1966).

[100] *Cuno Engineering Corp. v. Automatic Devices Corp.*, 314 US at 89. The US Supreme Court first interpreted the obviousness standard in *Graham v. John Deere Co. of Kansas City*, 383 US 1 (1966). In this case, the Court invalidated a patent because the patent claimed protection over a combination of elements where "the differences between them and the pertinent prior art would have been obvious to a person reasonably skilled in that art." *Id.* at 37. The America Invents Act of 2011, Pub. L. 112-29., amended the section on non-obviousness but kept the main clause:

> A patent for a claimed invention may not be obtained […] if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. 35 U.S. Code § 103 (2011).

[101] Under the flash of creative genius test, an AI machine makes most discover the outcome of constant and incremental efforts. Automated AIs require little in user input including flash of genius. Non-automated AIs may amount to tools that users deploy to invent. These tools could be construed as constant sustained effort that demand no flash of genius.

[102] Courts have compared "person having ordinary skill in the art" to the fictional "reasonable man" in tort law. See, e.g., *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1566 (Fed. Cir. 1987)(stating that "'a person having ordinary skill in the art' [is] not unlike the 'reasonable man' and other ghosts in the law."); *Antici v. KBH CORPORATION*, 324 F. Supp. 236 (ND Miss. 1971)(stating that "the 'person of average skill in the art' under § 103, who is the patent law equivalent of the 'reasonable man' of tort law, is neither a genius nor an expert"). As such, this fictional man changes over time.

[103] Rebecca S. Eisenberg, *Obvious to whom? Evaluating inventions from the perspective of PHOSITA*, 19 BERKELEY TECH. L. J. 885 (2004)(discussing what the person having ordinary skill in the art knows or should know). Note that PHOSITA stands for a person having ordinary skill in the art and has been used interchangeably with POSITA a person of ordinary skill in the art and PSITA a person of skill in the art.

[104] Brenda M. Simon, *The Implications of Technological Advancement for Obviousness*, 19 MICH. TELECOMM. & TECH. L. REV. 331 (2013).

[105] Without a non-obvious leap, the innovation may be anticipated. "Anticipation does not require the actual creation or reduction to practice of the prior art subject matter; anticipation requires only an enabling disclosure." See e.g., *Schering Corp. v. Geneva Pharmaceuticals*, 339 F. 3d 1373 (Fed. Cir. 2003). Or, the innovation may be cumulative but not sufficiently distance from current knowledge base to warrant protection. See e.g., Kristina B. Dahlin & Dean M. Behrens, *When is an invention really radical?: Defining and measuring technological radicalness*, 34 RESEARCH POLICY 717 (2005)(suggesting and testing a different definition of radical innovation to determine whether a cumulative invention ought to be patentable). Even then, AI-users face an uphill battle to satisfy the non-obviousness requirement under this enhanced standard. An invention may be found obvious for a number of reasons. "Exemplary rationales that may support a conclusion of obviousness include:

> (A) Combining prior art elements according to known methods to yield predictable results;
> (B) Simple substitution of one known element for another to obtain predictable results;
> (C) Use of known technique to improve similar devices (methods, or products) in the same way;
> (D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
> (E) "Obvious to try" – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;

However, AI could be construed as more than a tool. Whether an AI-user could patent such invention would depend on whether the AI's invention was "invented" or "discovered".[106] Individuals cannot protect something occurring in nature.[107] An invention must be man-made. Courts and policymakers may consider that AIs are more than tools. Those AIs could be compared to nature or sub-human entities. This more-than-a-tool aspect would negate the patentability of second-generation inventions.

In the copyright context, the AI-users has a stronger claim than creators or owners. Authors are assigned the copyright regardless of whether they used a tool.[108] Copyright does not divest in the tool creator; otherwise, pen or computer manufacturers would have long claimed every novel ever written.

However, the AI's work product may not be copyrightable. The U.S. Copyright Office has stated that it "will not register works produced by a machine or mere mechanical process that operates randomly or automatically without any creative input or intervention from a human author."[109] While the sweat of the brow doctrine has been rejected, the Copyright Office requires an author's involvement to protect works of arts. The AI-users cannot let the machine work autonomously. Random and automation are questions of fact and case law does not say where the threshold lies on the AI-tool spectrum.[110]

(F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;

(G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention." U.S. PATENT & TRADE OFFICE, 2143 Examples of Basic Requirements of a Prima Facie Case of Obviousness [R-08.2017], Manual of Patent Examining Procedure (9th ed., 2017), available at https://www.uspto.gov/web/offices/pac/mpep/s2143.html

Users would need to satisfy the teaching, suggestion, or motivation test. This test specifies that "a patent claim is only proved obvious if the prior art, the problem's nature, or the knowledge of a person having ordinary skill in the art reveals some motivation or suggestion to combine the prior art teachings." *KSR Intern. Co. v. Teleflex Inc.*, 550 US at 399 (2007).

[106] "[A]ny petitioner that 'hath . . . *invented or discovered* any useful art, manufacture, . . . or device, or any improvement therein not before known or used' if the board found that 'the invention or discovery [was] sufficiently useful and important'" Graham v. John Deere Co. of Kansas City, 383 US 1, 6-7 (1966) (emphasis added).

[107] See e.g., *Association for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576 (2013)(holding that naturally occurring DNA sequences cannot be patented whereas artificially created DNA sequences are patentable).

[108] In *Burrow-Giles Lithographic Co. v. Sarony*, 111 US 53 (1884), the US Supreme Court extended copyright to photographs. In doing so, the Court looked at the calibration of the camera as "original intellectual conceptions of the author." *Id*. at 60. The calibration was part of the creative process.

[109] The U.S. Copyright Office interprets this to mean that AI would not be granted copyright. *The Compendium of U.S. Copyright Office Practices: Chapter 300*, at 16, citing id. at 312.3, available at https://www.copyright.gov/comp3/chap300/ch300-copyrightable-authorship.pdf .

[110] AI works could come into two flavors: self-improvements and unrelated works. For self-improvement, the AI-users may be able to copyright the new sections of AI software. However, the AI-users may also have to negotiate with AI-creators to commercialize the AI-created work. For example, assume that the AI-creator writes a software intended to create new music. The AI-user would be able to copyright the music. 17 U.S.C. § 102(a) (1990). But, if the music can only be played by the AI and hence the music requires the inclusion of the AI-original software code to be played, then the subsequent invention would infringe on the original AI copyright. The AI-user may attempt to claim fair use. But the success of a fair use claim depends on "the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and […] the effect of the use upon the potential market for or value of the copyrighted work." 17 U.S.C. § 107 (1992). The AI-user may not defeat an infringement claim. However, copyright offers a narrow protection and as such would not protect the original AI-creator from secondary derivative works if the second-generation software was substantially different. Copyright does not protect "idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work."17 U.S.C. § 102(b) (1990).

If protection were to be awarded for the AI's work, users have a strong claim. But, if AIs were more than tools, their claims disappear. Instead, AIs may try to claim IP rights for themselves. The next section discusses whether this protection should be awarded to AIs.

c. Intellectual Property for Non-Humans

Some AI software are already capable of writing software.[111] As tech savvy individuals debate the dangers of AI,[112] one such machine named Sophia has been granted citizenship in Saudi Arabia.[113] As a citizen, this machine can own property including human-created patents and copyright. The next step would be for such machines to claim protection over their own creations. Such claim could challenge the definition and boundaries of intellectual property.

From a policy standpoint, the need to incentivize AI machines is unclear. Based on the current AI systems, they remain machines compliant to user demands. As such, if policymakers assign IP to incentivize knowledge creation, then AIs are a poor assignee. Even if AIs become sentient computers and autonomous, it is unclear whether they will exhibit the same incentive needs as humans.[114] These machines may not respond to traditional incentive mechanisms (i.e. promise of exclusivity, financial rewards, etc.). As such, the IP system would have to change to adapt to AI specific incentive system.

The current IP system incentivizes inventors and authors. These individuals respond to positive incentives such as the right to exclude others. They are also deterred by negative incentives such as infringement liability. If the AIs were granted protection and rights over their work product, they should also be liable for their infringements. Only under such a system where AIs could internalize the cost of their activities[115] would these AIs create knowledge creation at the socially efficient level. However, AIs may not respond to negative incentives (e.g., punishment) either. As such, the broader legal system would have to change to make AI liable and adapt to their deterrence system.

Under the current legal setting, AIs have the weakest claim. But this may change in the future. Non-human entities can already own property – including intellectual property; however, they cannot be the inventor on a patent application[116] or the author for a copyright

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[111] See e.g. Fan Long, & Martin Rinard, *Automatic patch generation by learning correct code*, 51 ACM SIGPLAN NOTICES 298 (2016); Tom Simonite, *AI Software Learns to Make AI Software*, MIT TECH. REV. (Jan. 18, 2017) https://www.technologyreview.com/s/603381/ai-software-learns-to-make-ai-software/

[112] Maureen Dowd, *Elon Musk's Billion-Dollar Crusade To Stop The A.I. Apocalypse*, VANITY FAIR (Apr. 2017) https://www.vanityfair.com/news/2017/03/elon-musk-billion-dollar-crusade-to-stop-ai-space-x; Peter Holley, *Bill Gates on dangers of artificial intelligence: 'I don't understand why some people are not concerned'*, WASHINGTON POST (Jan. 29, 2015) https://www.washingtonpost.com/news/the-switch/wp/2015/01/28/bill-gates-on-dangers-of-artificial-intelligence-dont-understand-why-some-people-are-not-concerned/ (last visited Apr. 18, 2018).

[113] Cleve R. Wootson Jr., *Saudi Arabia, which denies women equal rights, makes a robot a citizen*, WASHINGTON POST (Oct. 29, 2017) https://www.washingtonpost.com/news/innovations/wp/2017/10/29/saudi-arabia-which-denies-women-equal-rights-makes-a-robot-a-citizen/ (last visited Nov. 21, 2017).

[114] Andréa Morris, *We Need To Talk About Sentient Robots*, Forbes Magazine (Mar. 13, 2018) https://www.forbes.com/sites/andreamorris/2018/03/13/we-need-to-talk-about-sentient-robots/ (last visited May 11, 2018).

[115] Under the current legal, "robots cannot be sued." *United States v. Athlone Industries, Inc.*, 746 F. 2d 977 (3rd Cir. 1984). If AI were to reap the benefits of the IP system, they should also face the costs. Beside the incentive system, fairness may also dictate that AIs should fact the cost of infringing if they were to reap the benefit of protection. See e.g., David C. Vladeck, *Machines without principals: liability rules and artificial intelligence*, 89 WASH. L. REV. 117, 124 (2014)(discussing the idea that AI can be held liability in the future the way corporations are held liable).

[116] In patent law, the term "person" and "inventor" appear throughout the Act. See e.g., 35 U.S. Code § 102. "The term 'inventor' means the individual or […] individuals." 35 U.S. Code § 100 (f). This has been interpreted to mean human inventors. See e.g., *New Idea Farm Equipment Corporation v. Sperry Corporation and New Holland Inc.*, 916 F.2d 1561, fn. 4 (Fed. Cir. 1990)(" the judge properly recognized that people conceive, not companies"). Even under the joint work, an AI would not be able to share patent protection with the user.

claim.[117] AI could be assigned these rights as corporations already are. But they cannot claim these rights because they are not human.[118]

Challenges have been made to legally recognize non-humans as humans. *In the Matter of Nonhuman Rights Project, Inc., on Behalf of Tommy, v. Patrick C. Lavery*, a nonprofit organization advocated on behalf of two captive chimpanzees to grant them habeas relief and transferring them from captivity to a primate sanctuary.[119] Such a relief would require making them "persons." The Court of Appeal denied the motion but not without making a number of remarks *in dicta* that could well pave the way for animals (and possibly AI machines) to be construed as a person in the future.

Justice Fahey recognized that person may well be ill defined. Persons are not just entities that have "the capacity or ability . . . to bear legal duties, or to be held legally accountable for their actions" and provide the counter example of children.[120] Instead, Justice Fahey proposes a different test: "we should consider whether a chimpanzee is an individual with inherent value who has the right to be treated with respect."[121] Based on this test, animals and AIs may well one day be considered persons. If they are persons, then granting them IP right is not far away.

However, even if AI could be considered humans, AIs would face other problems to protect their inventions and works. For example, their innovations may be obvious. The POSITA for AI applicants should be AIs. A claim could be obvious to other AI machines and not patentable as such. The originality in copyright could also bar AI's work for being copyrightable.

The next section compares the different claims. It discusses whether the AI's work should just fall into the public domain.

4 THE PUBLIC DOMAIN AND THE INCENTIVE PROBLEMS

This section argues that all four knowledge creation participants (i.e. creators, owners, users, and AIs) should not be granted IP protection for those inventions or works. Instead, the IP should fall in the public domain.

a. Comparing Claims

AIs have themselves made IP more important to incentivize knowledge creation because they threaten how inventors or author can profit. Without IP, inventors and authors can recoup their investments by relying on secrecy[122] or on the first mover advantage.[123] However, AIs have threatened both recoupment methods. First, AIs jeopardize secrecy because they would make

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[117] In copyright law, "original works of authorship." 17 U.S.C. § 102(a) has been interpreted to require that the work be created by humans. In *Burrow-Giles Lithographic Co. v. Sarony*, 111 US 53 (1884), the Court focused on the "original intellectual conceptions of the author."

[118] See e.g., Naruto v. Slater, 888 F. 3d 418 (9th Cir. 2018)(discussing whether a monkey could be the author of a photo and finding that it lacked standing on the Copyright laws).

[119] *In the Matter of Nonhuman Rights Project, Inc., on Behalf of Tommy, v. Patrick C. Lavery, &c., et al.*, Motion No. 2018-268 (May 8, 2018 NY Court of Appeals). *In the Matter of Nonhuman Rights Project, Inc., on Behalf of Kiko, v. Carmen Presti et al.*, Motion No. 2018-268 (May 8, 2018 NY Court of Appeals) available at http://www.nycourts.gov/ctapps/Decisions/2018/May18/M2018-268opn18-Decision.pdf

[120] *Id*. at 3.

[121] *Id*. at 5.

[122] Reverse engineer remains a legal strategy to competitors. The AI itself could be reversed engineer if only protected by copyright – and so could its progeny. Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CAL. L. REVE. 1, 17 (2001) ("[V]irtually every court to consider the issue has concluded that there is a right to reverse engineer a copyrighted program for at least some purposes.").

[123] Stuart Graham, et al. *High technology entrepreneurs and the patent system: Results of the 2008 Berkeley patent survey*. 24 BERKELEY TECH. L. J. 1255, Table 1 (2009)(finding through surveys that practitioners prefer first mover advantage and secrecy over patent in the software industry).

reverse engineering easier. Second, AIs has decreased the first mover advantage because AIs would increase the innovation frequency. Once these recoupment methods are not available, innovators and authors would turn to IP protection to profit from their work.[124]

Based on this argument, IP protection may be necessary to incentivize knowledge creation. However, favouring one claimant creates incentive problems with the other claimants.

First, granting AI-creators the IP rights disincentivizes the purchase of AI and its use to create knowledge. AI-creators worry about the market for AIs. A rational AI-creator would rather negotiate with the AI-owners – possibly under a license instead of a sale – to ensure that their interests are aligned.

Second, granting AI-owners these rights disincentivizes AI-users. AI-owners must then address these issues through other incentive mechanisms. Such mechanisms often involve contractual negotiations to align owner and user interests. A rational AI-owners would then not care about the right assignment because they have to negotiate with creators for the purchase of the AI and with users to incentivize their work.

Third, granting AI-users these rights over-incentivizes their efforts and could decrease societal welfare. Once invented, AIs simplify the creative process. This simplification decreases the cost of the creative process. This decrease leads to more inventions and works of art. Inventors and authors keep producing as long as private marginal benefits still outweigh the marginal costs; but, society wants them to keep producing as long as societal marginal benefits outweigh societal marginal costs. These two points can differ because inventors and authors do not account for the externalities they create.[125] In such situation, the system incentivizes and protects more knowledge than is socially efficient.

Finally, a rational AI would not want to be assigned rights to its work product. Granting an AI these rights disincentivizes the users from using the AI because they would be foreclosed from using the created knowledge. In turn, this lack of use disincentivizes owners from purchasing the AI. This decreased demand also disincentivizes AI-creator from creating the AI. Thus, a rational AI would prefer others to be assigned the rights to its work product to ensure its existence.

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[124] See e.g., Petra Moser, *How do patent laws influence innovation? Evidence from nineteenth-century world's fairs*, 95 AMERICAN ECON. REV. 1214 (2005)(finding that innovators in the chemical industry started to rely on patents as a form of protection once reverse engineering became better).

[125] For example, one externality is the impact on cumulative innovations. Exclusion impede cumulative innovations. See e.g. Alberto Galasso& Mark Schankerman, *Patents and cumulative innovation: Causal evidence from the courts*, 130 QUARTERLY J. ECON. 317 (2014)(finding that post-invalidation invalidated patents are more likely to be cited as prior art). However, cumulative innovations can be more beneficial than the original. For example, at the societal level, if the original patent provides a small jump in knowledge from previous innovations but block more valuable cumulative innovations, this patent may be socially inefficient. In patent law, exemptions for using other patented invention are limited. 35 U.S.C. § 271(e)(1). Such exception include the research exemption. The US Supreme Court considered this exemption in *Merck KGaA v. Integra Lifesciences I, Ltd.*, 545 U.S. 193 (2005) and found that a patented drug can be used during clinical trial without infringing on the patent even if the research is not ultimately included in a submission to the Food and Drug Administration. In copyright, "the fair use of a copyrighted work" provides more leniency for cumulative works. The fair use of a copyrighted work includes "such use by reproduction in copies or phonorecords […], for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research, is not an infringement of copyright."17 U.S.C. § 107. The fair use doctrine "protects secondary creativity as a legitimate concern of the copyright." Pierre N. Leval, *Toward a fair use standard*, 103 HARVARD L. REV. 1105 (1990).

Table 1: Summary of the Different Options.

IP ASSIGNEE / *Issues*	CREATOR	OWNERS	USERS	AI
Current Legal Standard	Few rights	Some rights	Most rights	No rights
Patent Obviousness Problem	Obvious innovations flowing from previous steps.	Obvious innovations to AI-enhanced owners or researchers.	Obvious innovations to AI-enhanced researchers.	Obvious to other AI-machines.
Copyright Authorship Problem	Mechanical creation.	Mechanical creation.	Mechanical creation.	Mechanical creation.
Incentives (+) over-incentivized (-) under-incentivized (/) neutrally-incentivized	AI-creators: (+); AI-owners: (–); AI-users: (–); AIs: (/)	AI-creators: (–); AI-owners: (+); AI-users: (–); AIs: (/)	AI-creators: (–); AI-owners: (–); AI-users: (+); AIs: (/)	AI-creators: (–); AI-owners: (–); AI-users: (–); AIs: (/)

Table 1 summarizes the previous discussion. Depending on the claimant the law would either need to be clarified or changed to support their ownership claim over the AI-created knowledge. More importantly, no default rule balances the incentives if negotiations proved impossible: every IP assignment leads to under and over incentivizing.

Policymakers could approach the problem in different ways. They could assign the right in a way that causes the least amount of incentive distortions. Policymakers would have to weigh the over-incentivization of the assignee against the under-incentivization of the other parties. This balance may be impossible because of the counteracting interests involved.[126]

Instead, policymakers may opt to decrease transaction costs between the participants. This decrease would encourage negotiation between the parties and lead to the socially efficient outcome. Assigning clear rights help decrease transaction costs. But according to the Coase Theorem, the assignment itself is irrelevant. The party should be able to reach the socially efficient outcome regardless of initial right assignment if transaction costs are zero (or sufficiently low). The initial assignment only affects the bargaining power of each participants.

However, in a world with transaction costs, the assignment matters. In the three-party example, the AI-creator may never negotiate with the AI-users. In fact, the AI-user may be unknown at the time of the AI sale – making negotiation impossible and increasing transaction costs. Assigning the rights to AI-users or the AI-creators would increase transaction costs because it requires these individuals to negotiate when they would not have otherwise.

In this example, the assignment that leads to the lowest transaction costs is the AI-owner because AI-owners have to negotiate with both creators and users – regardless of the IP assignment. In more complicated systems, a right assignment based on this principle may not be possible.

Second, policymakers can assign the property right to the entity least incentivized to innovate based on cost-benefit analysis. At the margin, such an assignment should lead to the highest positive impact on the innovation system. Because the creator already profits via the sale of the AI, owners or users may need to be more incentivized at the margin. Even if the creator is not sufficiently incentivized through the sale, it could decide to exploit the AI to benefit more. This option is not available to the other potential assignees. Furthermore,

[126] If the AI-creator receives the IP rights, then the AI-owners and AI-users would be respectively under-incentivized to purchase and create knowledge with the AI. If the AI-owner receives the IP rights, then the AI-creator and the AI-users would be respectively under-incentivized to invent an AI and to create knowledge with it. If the AI-users receives the AI, the AI-creator and owners would be respectively under-incentivized to create and purchase the AI.

creators could profit through putting the AI to other use. Creators may not need to be granted protection and assigned the rights to the second-generation knowledge to be incentivized. Thus, policymakers may want to focus their attention on the owners and users.

Third, policymakers can assign the property right to the entity providing the greatest innovative input i.e. the "proximate cause". In this case, the users have the strongest claims because their actions are necessary for the creation of the IP. As discussed, the AI-creators may have had other use in mind for its machine. So, while they may be a cause-in-fact, they are not the proximate cause for the invention or works.

Fourth, policymakers can assign the property right to the entity with the most control over the output. Policymakers may view AI as a natural resource to be exploited. Property rights over natural resources usually falls within two systems: first possession and dominion (i.e. physical control).[127] In the AI case, the AI creator's claim would amount to first possession and the AI user's claim would amount to dominion. A dominion style rule would focus on the exploitation and extraction. Such rule presents judicial efficiency because it often is easy to prove.

None of these approaches solve the over and under-incentive problems described in Table 1. One solution is to create a new category of protection for AI-assisted inventions and works. Policymakers can play around the depth, breadth, and length of IP to cater to AI. Such AI could have a shorter life[128] and have higher filing and renewal fees to avoid over-incentive and the protection of socially inefficient inventions and works. These mechanisms can play an important role in discouraging socially inefficient patents.[129]

Beside these incentive issues, policymakers have to consider the cost and benefits of changing the rules. Policymakers will have to clarify the patent obviousness standard and whether AI should be construed as random or mechanical machines. Clarifying the rule before changing the rule is the first necessary step. Until then, AI-created knowledge should fall into the public domain as argued in the next section.

b. Public Domain

Even under the current system, parties have found solutions and contracted around IP issues. For example, IBM has opened the use of Watson, its AI, to consumers.[130] In doing so, IBM does not attempt to claim IP over the knowledge created. Instead, the users may try to claim protection. But granting protection may not be the solution to the AI-created knowledge.

This AI-created knowledge should fall into the public domain. First, every assignment creates incentive problems. Letting this knowledge falls into the public domain does not destroy all incentives – it only decreases the governmental created incentives. While AIs decrease the efficiency of secrecy and first mover advantage, AIs have created other means of recouping investment from the market. For example, AIs could increase the efficiency of

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[127] This discussion refers to the basics of possession illustrated in *Pierson v. Post*, 3 Cai. R. 175 (1805). See e.g., Carol M. Rose, *Possession as the Origin of Property,* 52 U. CHI. L. REV. 73 (1985)(discussing first possession rule of capture and first possession).

[128] Some scholars have already argued that the current copyright protection is longer than necessary to incentivize authors. See e.g., Kristelia A. Garcia & Justin McCrary, *A Reconsideration of Copyright's Term*, ALA. L. REV. (Forthcoming 2019).

[129] *See e.g.,* Gaétan De Rassenfosse & Adam B. Jaffe, *Are patent fees effective at weeding out low-quality patents?*, 27 J. ECON. & MANAGEMENT STRAT. 134 (2018)(finding that the value of patents increased after the introduction of renewal fees in 1982).

[130] IBM, *Getting started with Watson Analytics* (Nov. 21, 2017) https://community.watsonanalytics.com/wp-content/uploads/2017/11/wa_tutorial-3.pdf. IBM Watson Products and Services, IBM https://www.ibm.com/watson/products-services/ (describing the services provided by the Watson AI)(last visited Apr. 18, 2018).

secrecy by making duplication more difficult.[131] AIs could also make profiting more efficient because these machines could enable better catering and price discrimination,[132] which would transfer more consumer surplus to the AI-wielder.

Second, most assignments do not decrease transaction costs. They only shift the bargaining power of each party. For example, assigning the rights to the AI-owners does not decrease the likelihood of a creator holdout: creators may refuse to sell their AI unless the owners agree to transfer the whole profits from the AI's work product and threaten to exploit the AI themselves.

Third, letting this knowledge fall into the public domain increases judicial efficiency. For example, the AI-user has currently the strongest claim to the AI-created IP. However, this claim remains a question of fact about the human creation. The decision will move along a spectrum between no-AI-involvement and all user design and all-AI involvement and AI-design (see Figure 2).

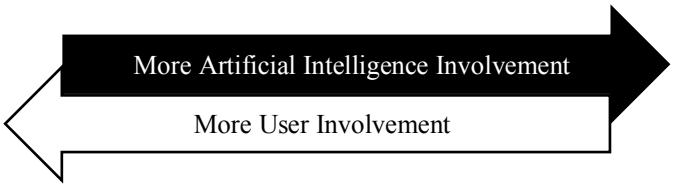

Figure 2: AI & User Involvement

Courts may decide to grant an AI-user an IP over an invention or work if the user is responsible for 51% of the creative process. However, this question can be complicated and onerous for granting agencies, the parties, and courts to decide.

Policymakers may find it more efficient to let all AI-created IP fall into the public domain. From a judicial efficiency standpoint, this option would lead to the fewest patent filings, copyright claims, litigations, and lowest enforcement costs. The cost savings could be substantial.[133] Policymakers may nonetheless want to complement this public domain doctrine by creating alternative incentive systems (e.g., incentive prices[134]) adapting to AI systems. Until then, AI-created knowledge should not be protected.

5 CONCLUSION

Artificial Intelligence is going to affect every aspect of our lives. It should be no surprise that it would affect Intellectual Property. Policymakers should get ahead of the problem as AIs are already in motion.

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[131] *See e.g.*, Shimon Rothschild, *Secure Software by Design*, 2018 IEEE INTERNATIONAL SYMPOSIUM ON TECHNOLOGIES FOR HOMELAND SECURITY (HST). IEEE, 2018.

[132] See e.g., Paul R. Milgrom & Steven Tadelis, *How artificial intelligence and machine learning can impact market design*, No. w24282. NBER, 2018 (discussing the use of computers to better price discriminate) https://www.nber.org/papers/w24282.pdf.

[133] The cost of enforcing innovation can be difficult to estimate. Some scholars have attempted to estimate the cost of enforcing patents that have not be enforced in the past in the context of patent assertion entities. The figure taunted is in the billions of dollar per year. *See e.g.*, James Bessen & Michael J. Meurer, *The Direct Costs from NPE Disputes*, 99 CORNELL L. REV. 387 (2014); James Bessen, Jennifer Ford, & Michael J. Meurer, *The Private and Social Costs of Patent Trolls*, 34 REGULATIONS 26 (2011). These costs are debated. *See e.g.*, David L. Schwartz & Jay P. Kesan, *Analyzing the role of non-practicing entities in the patent system*, 99 CORNELL L. REV. 425 (2014). They show that the cost of enforcement and litigation are non-negligible.

[134] For example, policymakers may opt to establish inducement prizes to incentivize authors and innovators. See discussion on inducement prizes fn. 12.

In December 2017, the US Congress and Senate passed a bill entitled the Future of A.I. Act.[135] In this Act, policymakers commission the Secretary of Commerce to establish the Federal Advisory Committee on the Development and Implementation of Artificial Intelligence, which was task to finding ways to incentivize development of AI.[136]

The Committee should not consider second-generation IP as a valid avenue because of the complication it would create for other IP creation participants. The Advisory Committee is to make a report and recommendations within two years of the Act.

This article discussed whether AI generated IP should be protected and if so, who should be the assignee. If we assume that this IP should be protected, then assigning IP to any participants has advantages and drawbacks. If policymakers favour fewest changes to the current system, then innovations could be patented by AI-users whereas works of art would fall into the public domain.

Along the way, this article stumbles along a litany of problems that would require amendment or changes because of the advent of AIs. For example, the POSITA standard may need to be adjusted for the involvement of AI in the creative process. This issue may well need to be addressed sooner rather than later.

This article discussed that policymakers may favour different goals. They may want to decrease transaction costs. With this aim in mind, the AI-owners may prove to be the better assignee. In general, policymakers may want to consider a whole new IP class for AI-generated works. But they may better serve society by letting the AI-created IP fall into the public domain. After all, patents and copyrights are not the only way for the knowledge creation participants to profit and be incentivized. The next step is to wait for different jurisdiction to tackle the problem differently and estimate the impact.

[135] 115th Congress 1st Session H.R. 4625.
[136] *Id*. Sec. 2.